DYNAWATT®

230V POWER SYSTEMS

4000

USER MANUAL

Installation
&
Operation

gratulations

on your purchase of a DYNAWATT 230V POWER SYSTEM 4000. You have now acquired a high quality, precision-manufactured power supply system for mobile use. Please read these Operating Instructions through carefully before using the system for the first time.
In any event, installation should only be carried out by a qualified technical workshop.

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SYSTEM DATA

The DYNAWATT 230V Power System consists of three parts. They are:

1. Generator	Figure 1	Page: 16
2. Control unit	Figure 2	Page: 17
3. Remote control	Figure 3	Page: 18 (option)

The basic system also comes with 2x installation brackets, 6m of generator cable.

Please note the following information on your system.

Generator: Series No. .....

Control unit: Series No. .....

Safety Precautions

- The DYNAWATT Power System 4000 generates an output voltage of 230V AC. When operating the system please therefore observe the general safety regulations for using electrical equipment. In other words e.g. do not allow any liquids to get into the housing, do not use any sharp instruments, in particular do not insert any metallic objects into the ventilation slot!
- The system is electrically insulated (galvanic separation between electronics and housing) and is not earthed to the chassis. (IT mains installation with potential compensation)
- When the engine is running the circuits are live. In order to ensure optimum cooling the unit must be installed vertically and the ventilation slots kept clear.
- All installation screws (installation kit) must be secured to prevent accidental loosening by using Loctite.

IMPORTANT

Installation and maintenance of the system should only be carried out by trained personnel. Any faults which are attributable to the use of components other than the components supplied by DYNAWATT AG, or the failure to observe the safety instructions as specified above, are not covered by the warranty.

A Power Transfer Switch must be installed if the vehicle (boat etc.) can also be connected to other power sources e.g. 230V external power (shore power), generator, inverter etc. Failure to comply with this instruction will cause damage to the control unit, this damage is not covered by the guarantee. Power Transfer Switches are available from DYNAWATT as an option.

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Technical Specification

CONTROL UNIT

Output voltage:	230V .AC ± 5%
Phases:	1 phase
Transformation:	250V by the generator to 230V
Frequency:	50 Hz ± 0.5%
Output wave:	sine wave
Output power:	400 Watt intermittent @ 6000 rpm generator 3500 Watt continuous (25 C temp.)
Start-up current:	23 Amp (2ms)
Efficiency:	96%
Weight:	7.8 kg
Protection category:	IP 21
System Protection:	System automatically shuts of by: overload, overheating or short circuit (double fault)
Dimensions:	See Figure 1

GENERATOR

Power output:	max. 4500 Watt
Output voltage:	3 x 250V AC
Output frequency:	variable, between 300 and 1500 Hz
Generator speed:	18,000 rpm intermittent 15,000 rpm continuous
Weight:	7.2 kg
Belt pulley:	DIA 57mm, 2 x 9,5mm belt
Efficiency:	70%
Insulation category:	H (170°)
Phase resistance:	3.4 Ohm ± 0.3 (from phase to phase)
Resistance rotor:	2.5 to 3.5 Ohm
Dimensions:	See Figure 2

REMOTE CONTROL

Switch:	STANDBY / ON
Indicators	add rpm, overload, overheating, short circuit
Connection cable length:	5m standard, 10m available on request.
Dimensions:	See Figure 3

Additional components

Power Transfer Switch

A Power Transfer Switch must be installed for switching over from an external power source (e.g. shore power 230V) to on board power source, DYNAWATT. Fig. 7.

List of Parts Supplied

1. Generator is supplied with 6m cable
2. Control unit

a. 2 pc. attachment brackets (loose)
b. 4 pc. M6 x 10mm attachment screws for brackets (on the back of Control Unit)
c. EMI fitting for the generator cable (on the front side of CU)
d. Fitting for the 230V cable (on the front side of CU)

3. Remote control with 5 or 10 m cable (available as an option)
4. User manual

Parts Required, Not Supplied

1. Three-conductor power cable, min. 3x1.5mm2
2. Vehicle-specific installation sets available on request.
3. 4 pc. attachment screws for the Control Unit

Generator Speed and Available Power

Calculation Sheet

(Note: Measure the belt pulley external diameter)

Generator speed

Belt pulley dia. generator side:	Ra = ... mm
Belt pulley dia. motor side:	Rm = ... mm
Motor speed idling:	nL = ... rpm
Motor speed max.:	nM = ... rpm
Belt pulley transmission:	iR = Rm : Ra= .....
Generator idling rpm:	NA_{Idling} = (iR) x (nL) = ... rpm
Generator max. rpm:	Na_{max} = (iR) x (nM) = ... rpm

Available output in watts

Read from the Curve of Figure 21

Power at engine idle speed (NA_{Idling})	..... Watt
Minimum speed for full load	..... rpm

Introduction

MANUAL CONTENT

This manual covers: Operating Instructions, Installation Guidelines and Installation Instructions.

SYSTEM DESCRIPTION

Generator and Control Unit

The system consists of a high performance generator which is belt-driven by the main engine and controlled by the control unit. Whenever the engine is on, a precisely controlled 230V power source with 50 Hz sine wave AC is available. Once the system is installed, the operation of the system is automatic, including automatic shutdown if an overload or short circuit occurs.

Remote Control

The remote control provides a **POWER ON** and **STANDBY OFF** switch and has 4 LED status and fault indicators.

Power Transfer Switch

A Power Transfer Switch is required for switching between an external power source (230V mains) and the DYNAWATT Power System.

WARNING
Voltage must never be connected to the control unit! Return voltage will immediately result in the control unit being damaged!!
NO WARRANTY

OPERATION

Figure 4. At full power the system delivers 4000 Watts AC and can deliver higher peak out put on a temporary basis. However, the system automatically shuts off in the event of a continuous overload. This chapter explains how the user can avoid this situation arising. It deals with four areas.

1. Motor speed
2. Overload
3. Start phase
4. Remote control

Engine speed

At idling speed the generator delivers a percentage of its potential output. Generation of the maximum output requires a higher engine speed. Figure 4 shows a performance curve for calculating the drive ratio, the output available from the system on idling speed and the minimum engine speed required in order to achieve the system's maximum output.

Overload

With most overload situations there are three adjustment options.

1. Reduce the electrical load
2. Increase the motor speed slightly
3. Shut off the entire power consumption temporarily by switching off the control unit or switching to STANDBY on the remote control. This option avoids the system automatically shutting down. The load must then be reduced or the motor speed first increased.

Start phase

Electrical consumers (in particular electric motors) take up far more current when they are switched on than when in operation. Electric motors are amongst the biggest 'consumers of electricity', e.g. an air conditioning system which requires 6 - 7 amps when running operation can require a starting current of up to 50 amps. The DYNAWATT 4000 delivers up to 23 amps starting current. In some situations the user will have to follow the start-up procedure as shown below:

1. Switch off all loads
2. Switch on the largest load first
3. Switch on the remaining small loads.

If the starting current for a load is too high then a soft start can be connected between the DYNAWATT and the user. The soft start reduces the starting current by up to 70% by electronically slowing down the start-up speed of the user. This enables motors with considerably higher starting currents to be operated.

Remote control (option)

STANDBY

The system is switched to 'STANDBY' by pressing the toggle switch. In this state there is no voltage and the 'STANDBY' LED light comes on.

POWER ON
Pressing the toggle switch to 'POWER ON' activates the system. The 'ON' LED light comes on if the system is switched on.

NOTE
The control unit mains switch must be set to ON if the remote control is used. Otherwise it will not function.

INCREASE SPEED

The control unit continuously measures the power output. If the voltage falls by more than 5% under load or because the generator speed is too slow, with the result that the power output is no longer sufficient for the current level of consumption, then the control unit increases the magnetising voltage. Once this reaches the maximum of 14V and the voltage generated is still below 218V then the 'ADD RPM' LED light comes on.

Remedy: - Increase engine speed
- Check belt tension for slippage, tighten or replace belt

OVERLOAD

Under a continuous heavy load the voltage falls to 180V and the current limiter limits the output current to 17.5 amps. The system can however still continue to be operated without any problem although the 'OVERLOAD' LED will come on.

If there is a sudden heavy load increase the system automatically shuts off and the 'OVERLOAD' LED light comes on.

Remedy: Reduce the load, after approx. 20 seconds the system automatically switches itself back on. It can however also be switched off briefly and then back on again.

HIGH TEMPERATURE Overheating

A continuously high load or an overload can cause the system to overheat. If the system reaches a temperature of **62°**C the 'HIGH TEMPERATURE' LED **light starts to flash**. At **65°**C the system automatically **shuts off**. The system only switches back on automatically once it has cooled down to 52°C.
The cause of the overheating can be either incorrect installation, inadequate cooling or a defective fan.

Remedy: Check that the Control unit is well ventilated. Test the fan operation, if a suction filter is used the filter may need to be cleaned.

SHORT CIRCUIT

In the event of a short circuit or a very high load (<70 amps) the control unit automatically switches off and the 'SHORT CIRCUIT' LED light comes on.

Remedy: Switch off the unit and rectify the fault. Then switch the unit back on again. The system does not switch back on automatically after a short circuit.

System ON and OFF

If the system has been turned off by engine shut down the ON / OFF switch must be rest
to off and on again otherwise the system will not start.

Periodic Maintenance

V-Belt

The system does not need any periodic maintenance with the exception of checking the V-belts which are used to drive the generator. We strongly recommend purchasing replacement belts. Where a twin belt system is used both belts must be replaced simultaneously. **Only high performance belts should be used, such as e.g. GATES Type ESC or CONTI Industry**.

NOTE
A new V-belt will expand during the first hours of operation and the tension must therefore be subsequently adjusted after the first 10 hours.

Generator Bearings and Brushes

Depending upon the load and the extent to which the system is used the brushes and bearings should be replaced after approx. 1000 hrs or 80,000 km. Please contact your nearest DYNAWATT dealer for replacements.

Installation Guidelines and Safety Precautions

IMPORTANT

It is essential for the system to be installed professionally to ensure reliable operation over a long period of time. The mechanical installation of the generator is of particular importance. In the event of any problems occurring please contact your DYNAWATT dealer.

GENERATOR

A number of factors must be taken into account to ensure the generator is correctly installed. Particular attention must be paid to the correct selection criteria.

1. Installation site and stability
2. Choice of belt pulley for the right speed range
3. Choice of belt for minimum system maintenance
4. Belt positioning, alignment and tension.

Installation Site

The generator can:

1. be fitted to the engine block as an addition to the existing alternator
2. be fitted next to the engine. This requires a special, automatic belt tensioned which is available as an accessory.
3. Whichever choice you make it is essential for the generator to be installed securely.

INFORMATION

The generator cable should be laid in a separate protective conduit to safeguard it from mechanical effects.

Choice of Belt Pulley

See Figure 4; System Performance curve. The curve shows that no output is delivered by the system until the generator speed reaches approx. 2900 rpm. and the system generates a 50% output at a generator speed of approx. 3700 rpm.

To achieve the best results the system should reach a minimum generator speed of 3500 rpm at engine idle

Generator maximum speed: 15,000 rpm continuous
18,000 rpm maximum

Choice of Belt

The power which is transferred via the belts depends upon the belt width, wrap-around angle, the number of belts and the belt tension. The service life of a single belt system is considerably less than that of a twin belt system.

DIA pulley	Belt size	Type	Qty	Max. output
65 mm	12.5mm	12.5 ESC toothed	1	2500 Watt
57 mm	**9.5mm**	**9.5 ESC toothed**	**2**	**4000 Watt STANDARD**
65 mm	12.5	12.5 ESC toothed	2	>4000 Watt
50 mm	Micro-V	Micro-V 6 grooved	1	4000 Watt

Belt Pulley Alignment

Nothing is more important for the service life of a belt than the alignment of the generator pulley and engine pulley. Both pulleys must be absolutely parallel and flush aligned. If a pulley is positioned at an angle to or slightly behind the other this can lead at least to a material related reduction in the useful life of the belt. In addition the belt may slip out of the grooves.

INSTALLATION

Generator Installation

Figure 9. The generator is fitted as an additional alternator. It must be securely and permanently installed since the drive takes two to three times more power than factory-fitted standard alternator. The ratio to be taken into account during installation is dependent upon the engine idling speed and the maximum speed.

NOTE
All installation screws must therefore be secured using Loctite to prevent accidentally working loose.

Fitting the generator cover

The generator cover must be positioned in such a way that the generator is able to take in dry, cool air via the intake opening (DIA. 55 mm). If this is not possible then a **suction hose must be connected to the opening** to provide dry, cool air and must be fitted in an appropriate position in the vehicle. The higher the air intake temperature the greater the heat related loss of generator performance. See Figure 9.

Generator Magnetization

The generator must be magnetized before installing it otherwise the system may not operate at all.

Attach the 12 volt generator cable, ***No. 4 (+) plus****,* ***No.5 (-) minus*** *to a 12 volt battery for approx. 30 seconds.*

WARNING
On no account must this be carried out whilst the engine is running and the Control Unit connected. The Control Unit will be immediately damaged by high voltage. NO WARRANTY

Engine rpm control

To enable the idling speed to be increased we recommend fitting a hand throttle or an automatic engine speed accelerator. Available as an option.

Control Unit mounting

The control unit is to be installed in a well ventilated, dry place with average temperature levels. See Figure 8. The ideal position is against a wall, cable connections at the bottom. For this the two brackets, supplied separately, are screw connected to the rear of the control unit. ***The control unit must not be installed horizontally***, it is important to ensure that the air outlet slots on the reverse are not blocked.

WARNING
The brackets must only be fitted to the rear of the Control Unit by using the supplied M6 screws, with a **maximum length of 10 mm.**

Connection the generator cable

The five conductor generator cable has to be prepared as shown in Figure 5. Open the front cover of the control unit (undo 3 screws) and insert the cable into the housing through the metal fitting. Lead the numbered cables (1-5) to the correct terminal number and attach. To attach the cable press the terminal clamp down by using a small screwdriver. Ensure the cables are securely clamped. The cable shield mash is fitted as shown in Figure 5. Then gently tighten the screw connection using an SW 30 mm spanner. Make sure that the gen.cable is not turning around while tightening.

Cable function:	No.	Function	Terminal No.	Voltage
	1	1st Phase	L (1)	250V AC
	2	2nd Phase	L (2)	250V AC
	3	3rd Phase	L (3)	250V AC
	4	(+) Magnetizing current	+ (4) red	+12V DC
	5	(-) Magnetizing current	- (5) blue	- 12V DC

230V Connection

Prepare cable as shown in Figure 5 and pull it through the plastic screw connection into the Control Unit. Attach cable to the output filter terminal clamp. Ensure secure fit. Minimum recommended cable size: 3x1.5mm2. (Cable up to 4mm2 possible)

230V connection terminal function:	Terminal No.	Function	Cable colour
	L	**Phase**	**Brown**
	N	**Neutral**	**Blue**
	E	**Earth**	**Yellow/Green**

Starting the System

The following must be checked before starting the system:

- that the generator cable has been correctly installed
- that the V-belt tension has been correctly set
- that all installation screws have been tightened
- that the cables have been connected to the correct terminals and are securely clamped.
- when unit is switched ON, check if fan is operating

Troubleshooting

The system doesn't work	Check the condition and tension of the V-belts. Check the cable and terminal connections.
LEDs on the remote control faint but no power	Check to see whether cable 4 (+) and 5 (-) have been connected the wrong way around or whether generator must be magnetized again . See Page 14.
Increase Speed Light comes on	V-belt slipping, check tension and condition, adjust tension.

Testing the Generator

With generator turning:	250V AC must be measured on the terminal from phase to phase (1-2-3). **(Warning, high voltage**)
With generator stationary:	The resistance on the terminal from phase to phase (1-2-3) must be 3.4 ohms +/- 0.3.
If fault displayed:	*Contact supplier*
Rotor resistance:	2.5 to 3.5 ohms between cable no. 4 (+) and 5 (-)
If fault displayed:	*- Check generator carbon brushes* *- Clean collector ring with fine sandpaper if necessary*

Warranty Terms

1. This warranty applies to new products and accessories sold by DYNAWATT AG The system is guaranteed for material and production defects. The warranty only covers the unit itself and not any consequential damage.

2. Coverage Duration:
   24 months beginning of the date of delivery to the first user

3. The product must be used and installed in accordance with the details contained in the DYNAWATT operating instruction manual.

4. The warranty only covers the unit itself and not any consequential damage

   Not covered under warranty:
   - R&R (remove and reinstall) cost and travel expenses, are to be borne by the applicant unless expressly agreed otherwise.
   - faults and repair costs caused as a result of improper use, modifications or incorrect installation
   - injuries and indirect damage to vehicles etc.
   - consequential costs and costs incurred due to loss of vehicle
   - moving parts such as V-belts, LED’s, plastic components etc.

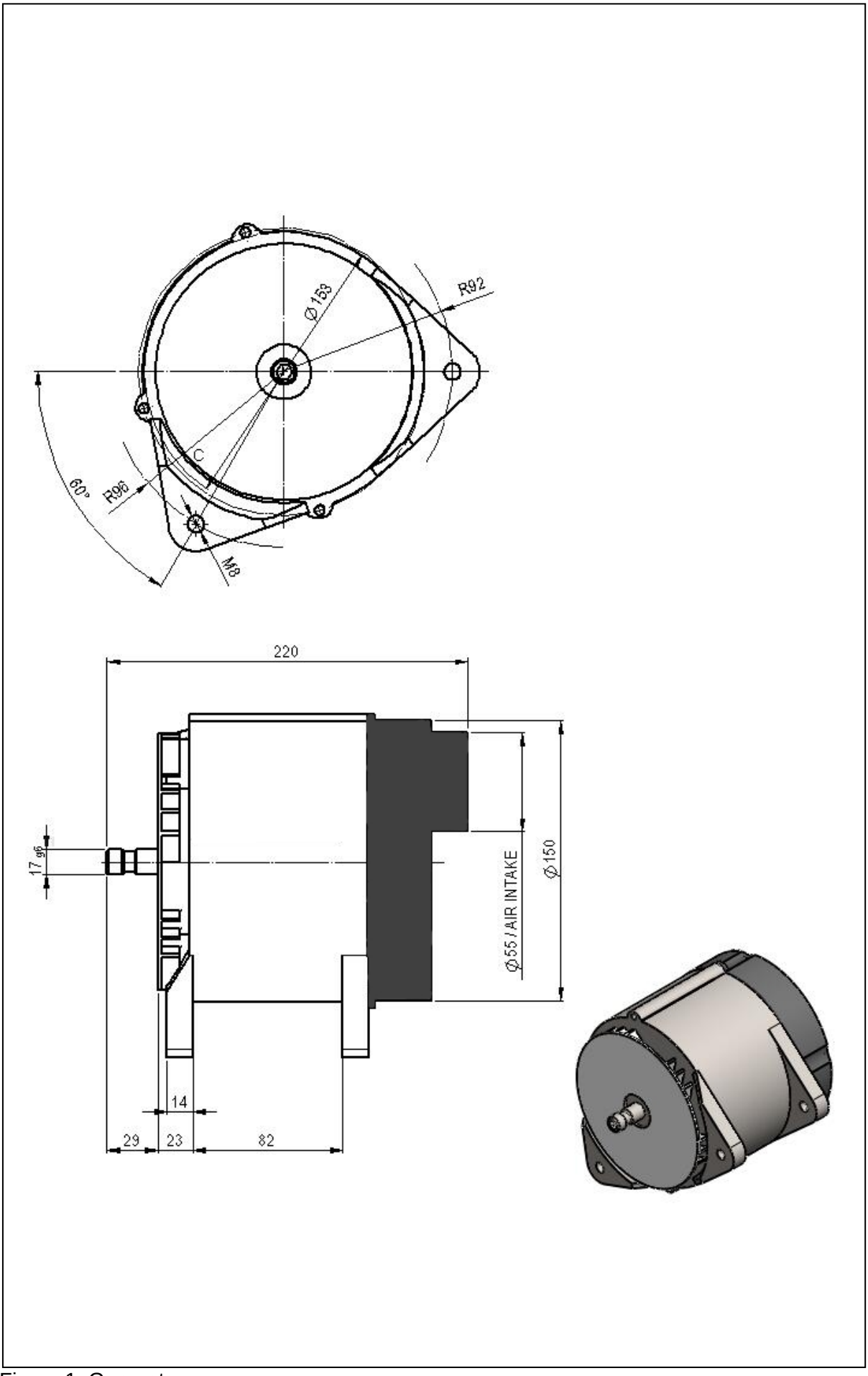


Figure 1. Generator

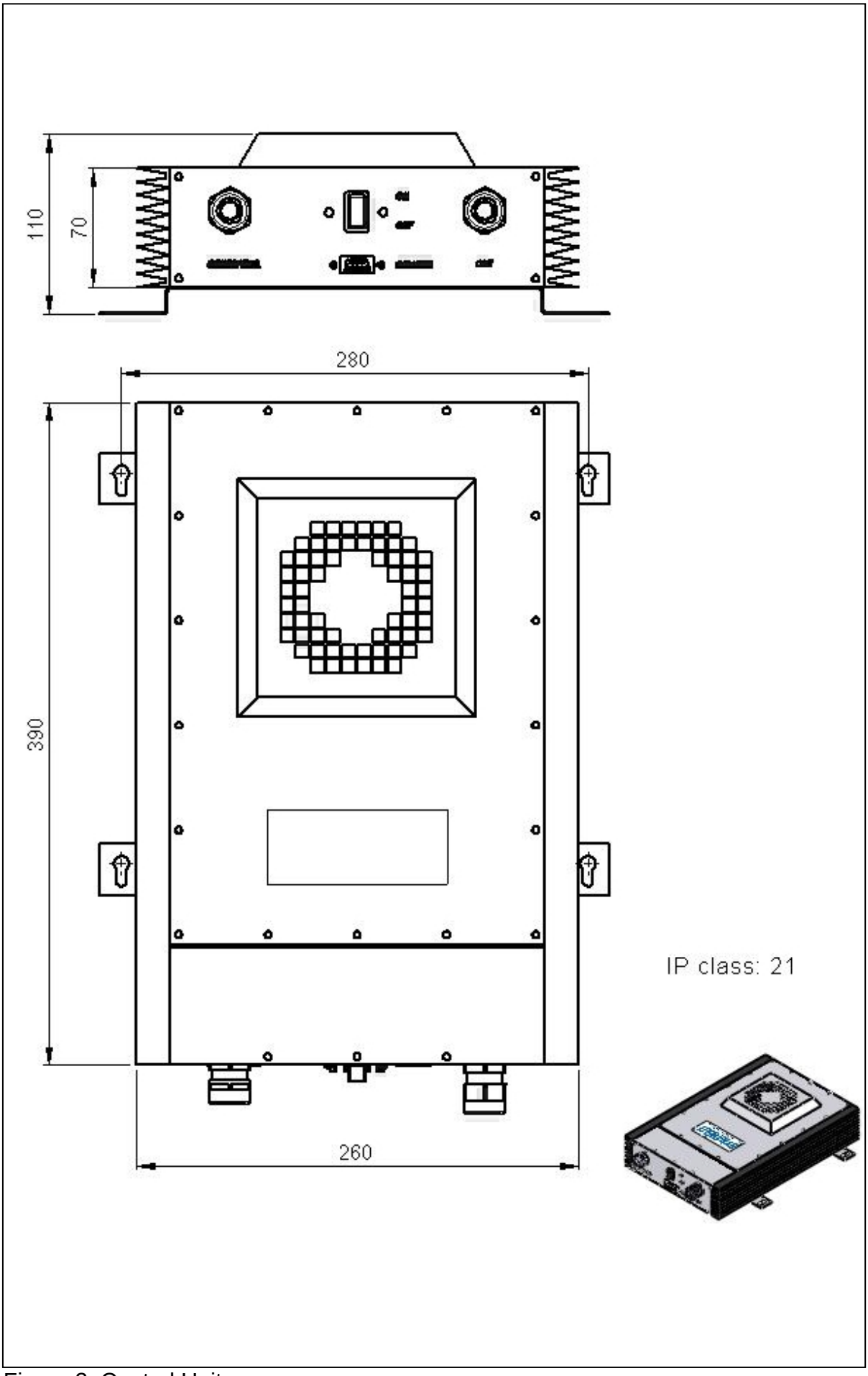
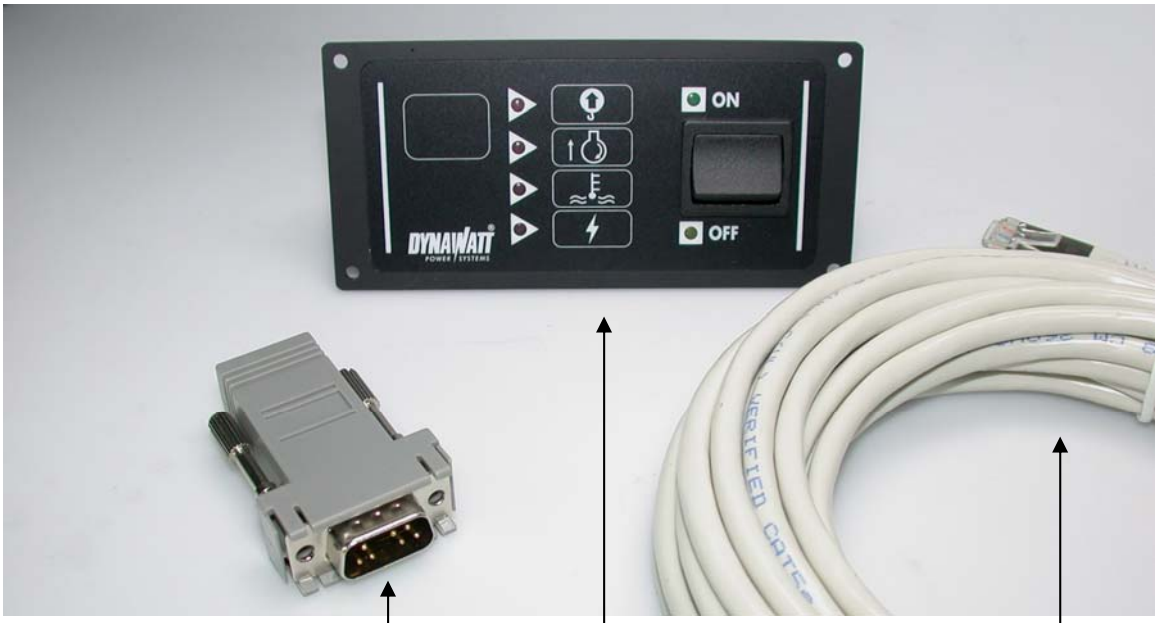


Figure 2: Control Unit



P 30118

Adapter
RJ45-SUB D9

P 30115

Remote control
RJ45 connector

P 30115-70

Cable RJ45 7m

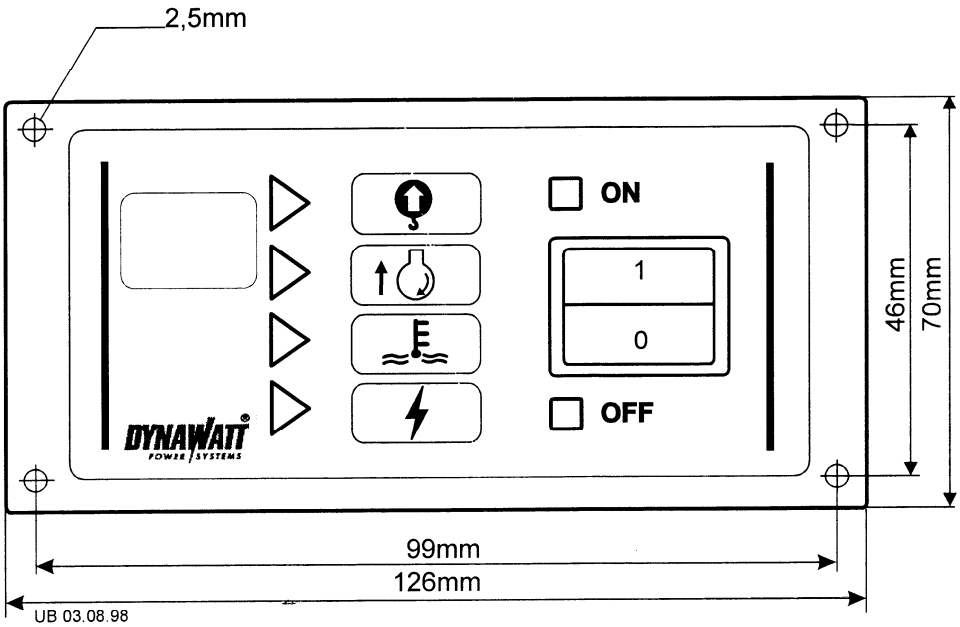


Figure 3: Remote Control

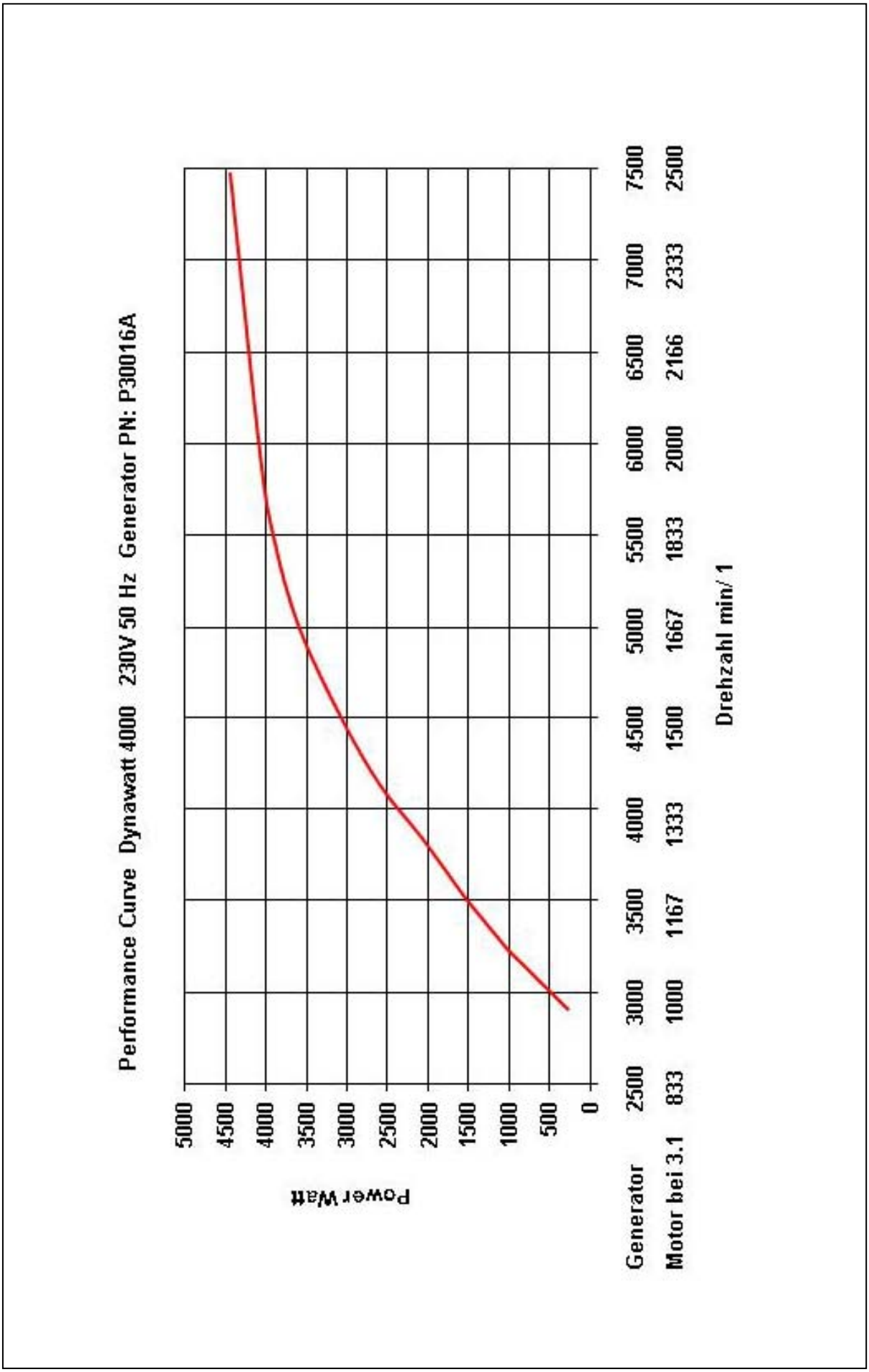
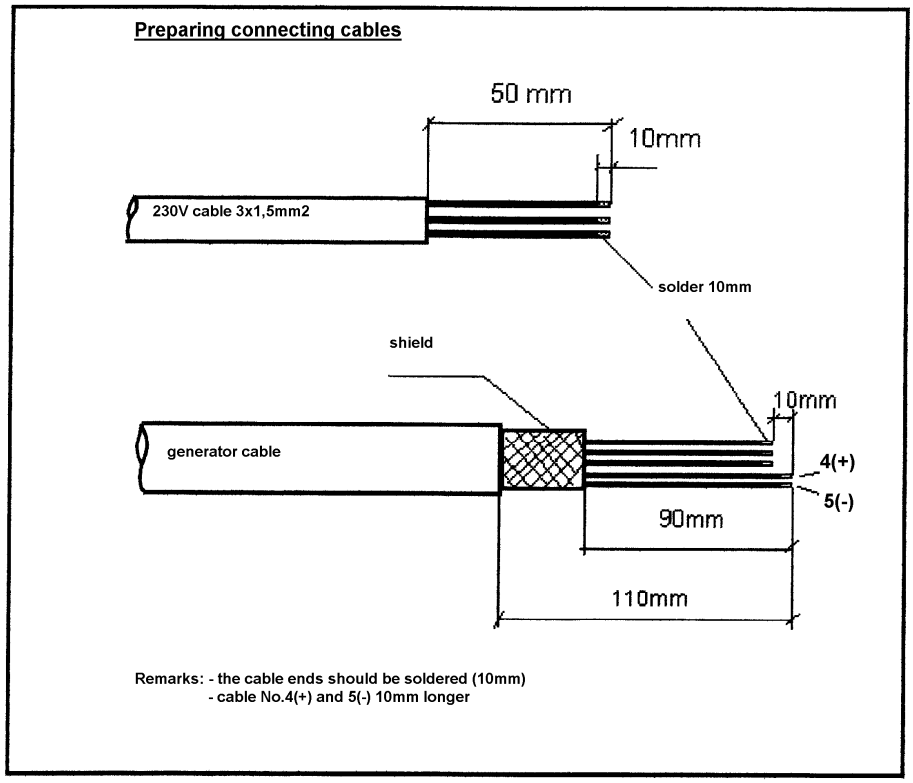


Figure 4. Generator Performance Curve



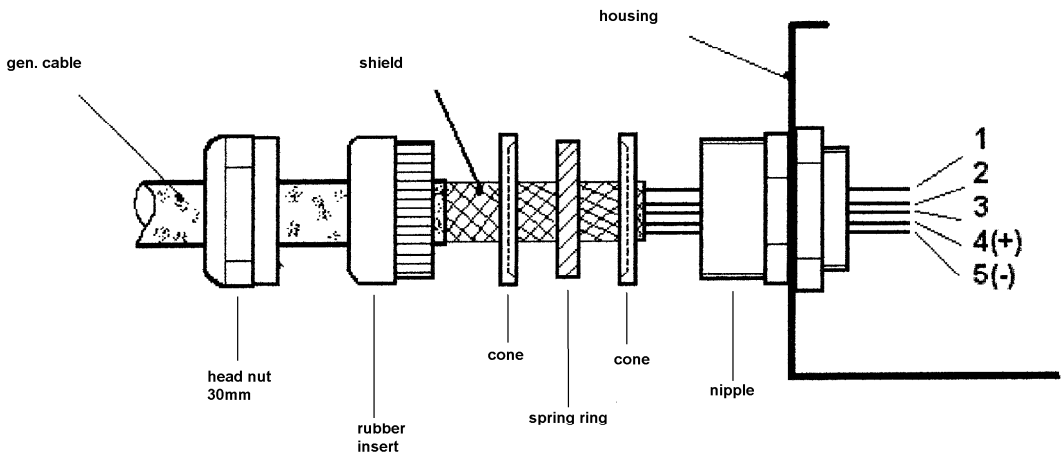


Figure 5. Preparing cables

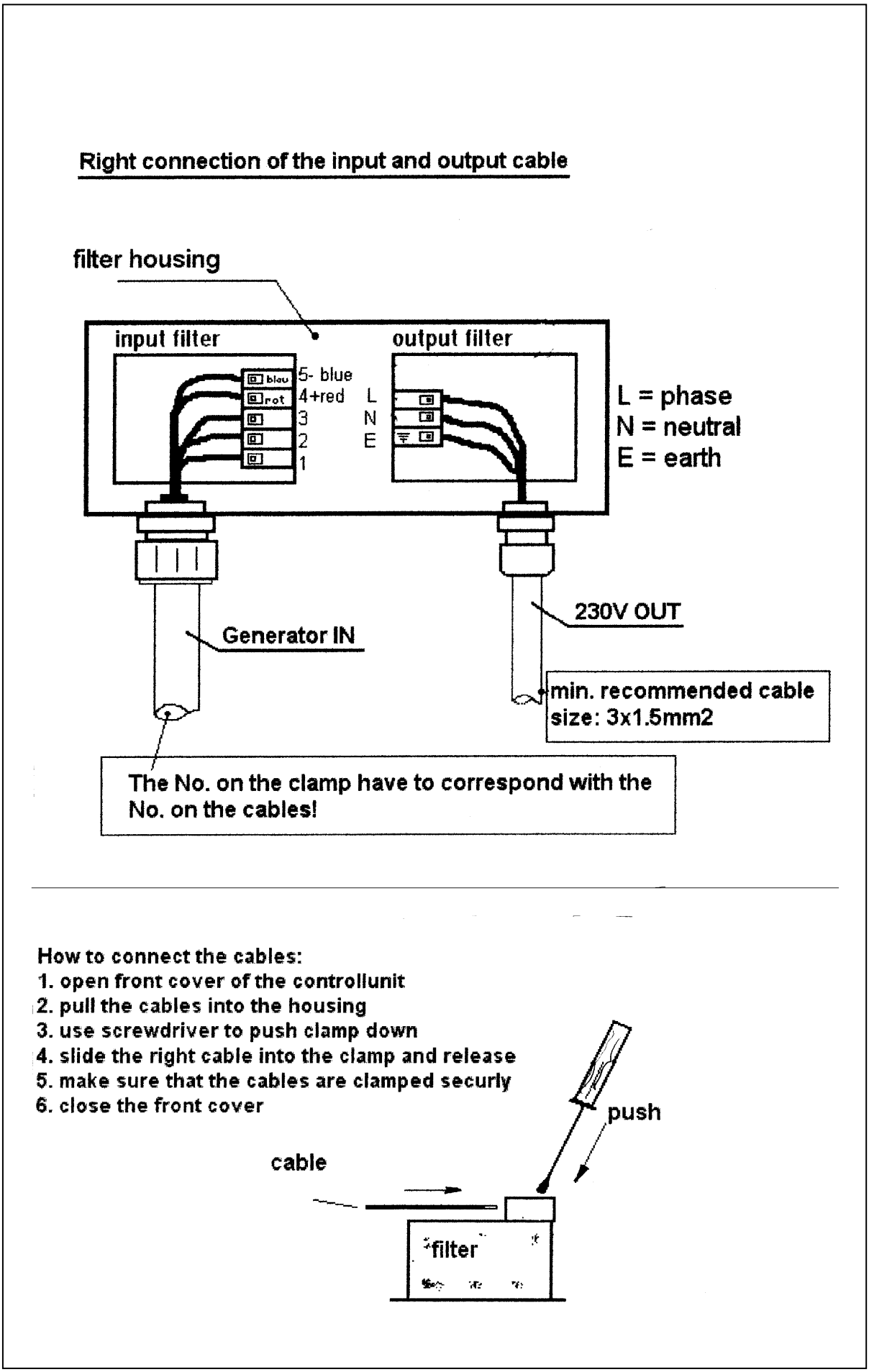


Figure 6: Connecting Terminals

Automatic power transfer switch for shore DYNAWATT power

Connect the power transfer switch at any dry place in the vehicle or boat. Connect as shown will have shore power as first priority power source.

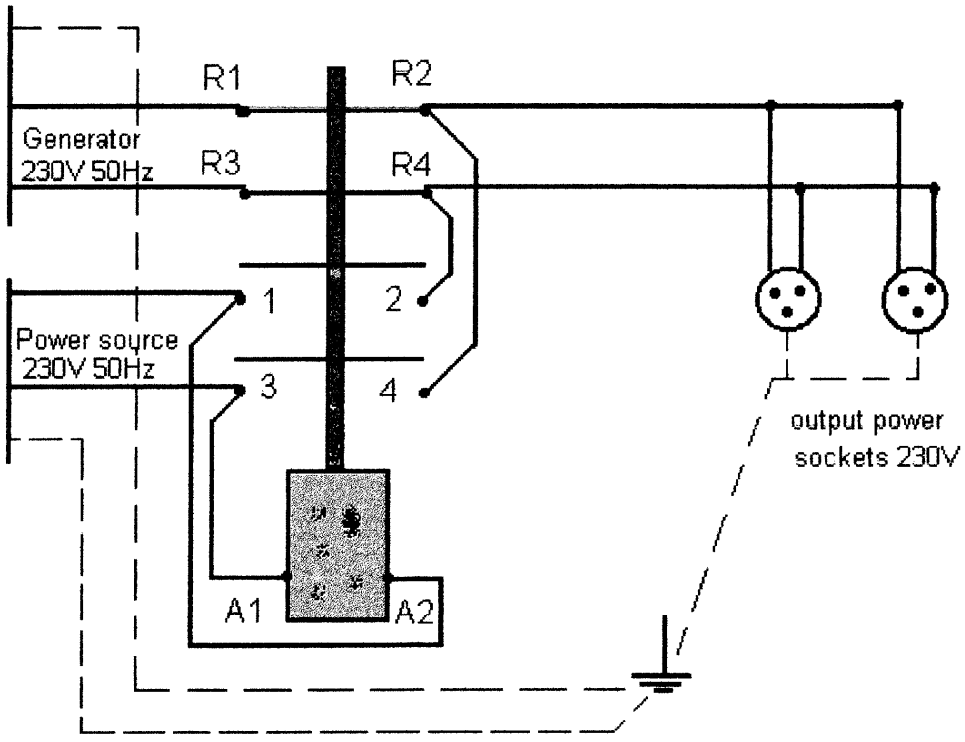


Figure 7: Power Transfer Switch

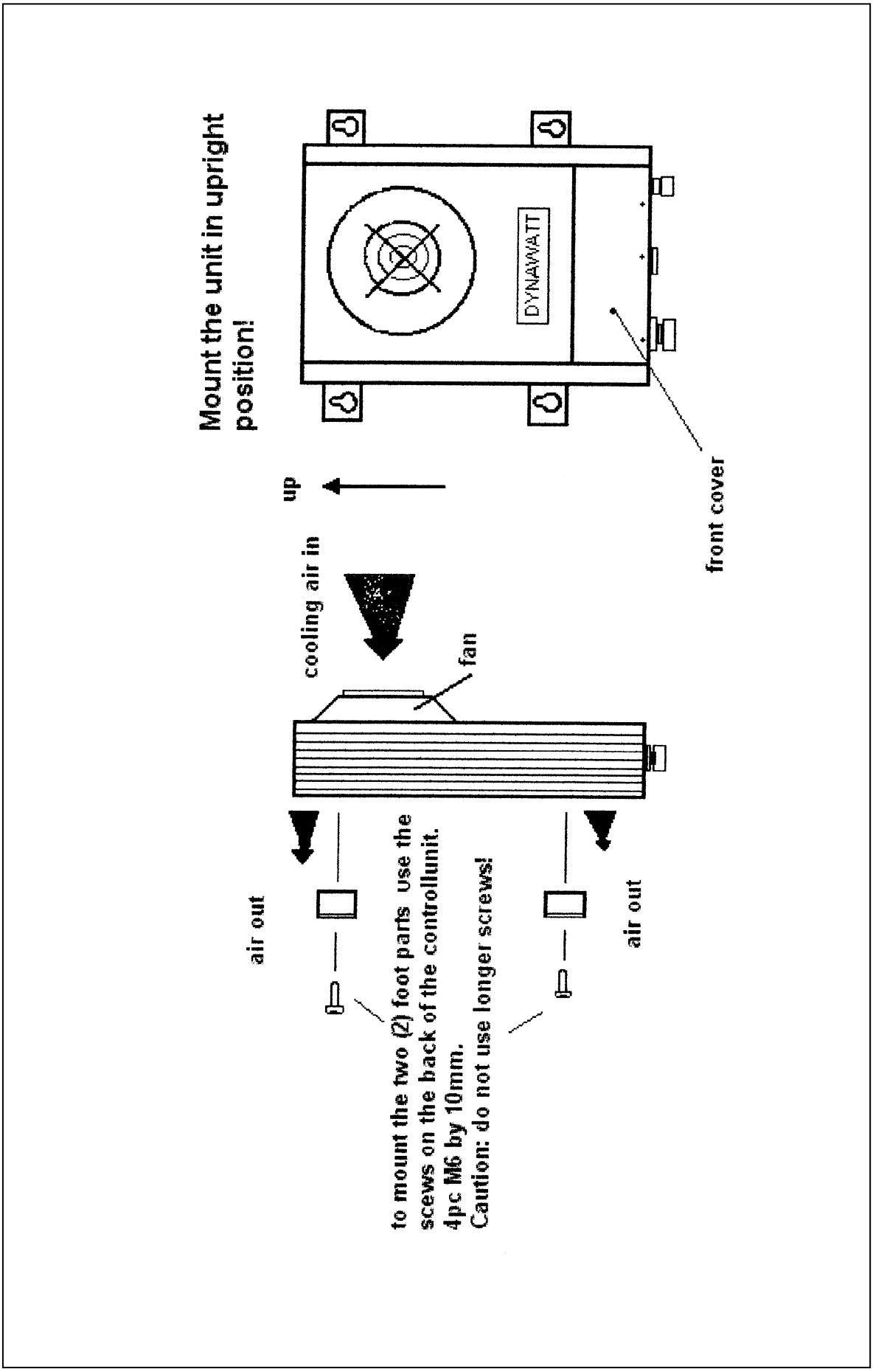
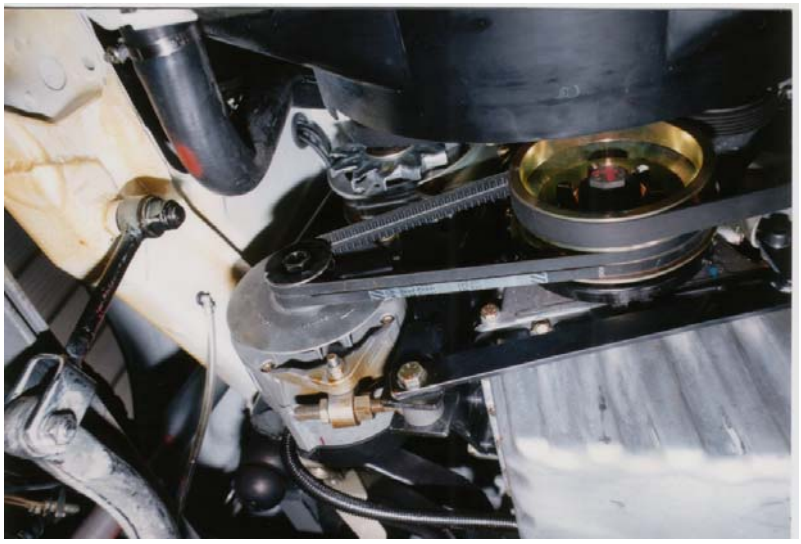

Mount the unit in upright position!
DYNAWATT
front cover
up
cooling air in
fan
air out
air out
to mount the two (2) foot parts use the scews on the back of the controllunit.
4pc M6 by 10mm.
Caution: do not use longer screws!

Figure 8: Control Unit Installation



Generator Installation with 2 x 9,5 mm V-Belts

Generator with DIA 55 mm air intake hose
Cut any place at the rear cover for gen.cable exit

Figure 9: Generator Installation

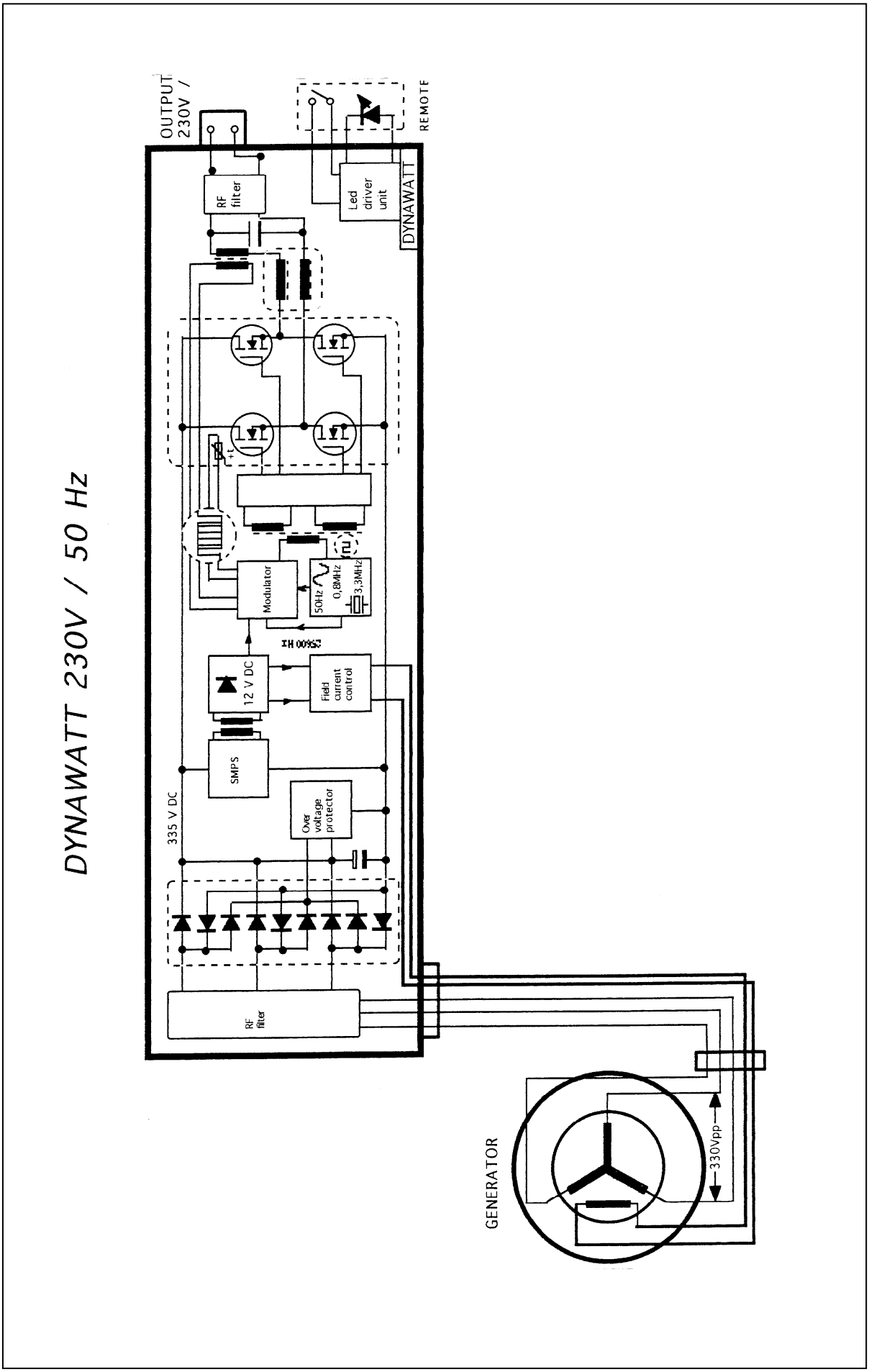


Figure 10: System Block Diagramm